

ABSTRACT

An autonomous subsurface drilling device has spaced-apart forward and rearward
5 "feet" sections coupled to an axial thruster mechanism between them to operate using an inchworm
method of mobility. In one embodiment, forward and rearward drill sections are carried on forward
and rearward "feet" sections for drilling into material in the borehole in both forward and rearward
directions, to allow the device to maneuver in any direction underground. In another embodiment, a
front drill section has a drill head for cutting into the borehole and conveying cuttings through a
10 center spine tube to an on-board depository for the cuttings. The feet sections of the device employ
a foot scroll drive unit to provide radial thrust and synchronous motion to the feet for gripping the
borehole wall. The axial thrust mechanism has a tandem set of thrusters in which the second
thruster is used to provide the thrust needed for drilling, but not walking. A steering mechanism
composed of concentric inner and outer eccentric rings provided with the rearward feet section
15 allow small corrections in both direction and magnitude to the drilling direction as drilling
commences.